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| **Lesson Title:** |
| **Subject area / course / grade level:** |
| **Introduction:** Interactions between organisms; and between organisms and their environment affect a population. Limiting factors, such as food, water and living space, limit the size of populations. When a population reaches it’s largest size, it is known as it’s “carrying capacity.” A key goal for instruction on algebra at the elementary/middle school level is to analyze change, and to understand how change in one variable can relate to change in a second variable. The goal of this lesson is for students to explore how changes in time affect the carrying capacity of the paramecium population. |
| **Lesson Length:1 50 minute class** |
| **Materials**: Student Computers with internet capability, Population Data table for Paramecium (Single Celled microorganism), <http://nces.ed.gov/nceskids/createagraph/default.aspx> |
| **Lesson Overview:** Students will use an online data tool to plot a graph from a data table that shows the carrying capacity of the paramecium population. |
| **Tennessee Standards:Science:**   |  | | --- | | **SPI 0607.Inq.1** Design a simple experimental procedure with an identified control and appropriate variables.  **SPI 0607.Inq.2** Select tools and procedures needed to conduct a moderately complex experiment.  **SPI 0607.Inq.3** Interpret and translate data in a table, graph, or diagram.  **SPI 0607.Inq.4** Draw a conclusion that establishes a cause and effect relationship supported by evidence.  **SPI 0607.Inq.5** Identify a faulty interpretation of data that is due to bias or experimental error.  **SPI 0607.2.1** Classify organisms as producers, consumers, scavengers, or decomposers according to their role in a food chain or food web.  **SPI 0607.2.2** Interpret how materials and energy are transferred through an ecosystem.  **SPI 0607.2.3** Identify the biotic and abiotic elements of the major biomes.  **SPI 0607.2.4** Identify the environmental conditions and interdependencies among organisms found in the major biomes. | |
| **Lesson objective(s):**  **Students will:**   * **Understand how limiting factors and carrying capacity of populations are related** * **Understand why ecological interactions are important** * **represent data collected on two variables in a line graph format** * **understand how changes in one variable relate to changes in a second variable** * **develop an initial understanding of statistical concepts including slope** |
| **ENGAGEMENT**   * Describe how the teacher will capture students’ interest. * What kind of questions should the students ask themselves after the engagement?   **Ask students: What are the resources that a population needs to live? Write their answers on the board and discuss. Label each: abiotic or biotic. Demonstrate a virtual aquarium and the delicate balance that must be kept to keep the fish alive.**  **http://www.fossweb.com/modules3-6/Environments/activities/virtualaquarium.html** |
| **EXPLORATION**   * Describe what hands-on/minds-on activities students will be doing. * List “big idea” conceptual questions the teacher will use to encourage and/or focus students’ exploration   In this lesson these data will be plotted as a line graph. Patterns in the data will be examined and analyzed to help students understand how changes in one variable (time) are related to changes in a second variable (number of paramecium). Statistical concepts of sampling, the law of large numbers, and variability should emerge in the classroom discussion that is facilitated by the teacher.  Give students the Paramecium Growth data table shown below.  The population data table below shows the growth of a species of Paramecium, a single-celled microorganismover 18 days. Food was added to the test tube occasionally.  Paramecium (single –celled organism) Growth   |  |  | | --- | --- | | Number of Paramecium per ml | Days | | 9 | 0 | | 25 | 3 | | 65 | 6 | | 65 | 9 | | 65 | 12 | | 65 | 15 | | 65 | 18 |   Explain that in this experiment over 18 days, food was added at regular intervals. Ask the students if they are able to determine from the data table if the population of paramecium was increasing, decreasing or staying the same. Also, ask if the population of paramecium was increasing at a constant rate.  Ask them if they think a graph would help them decide if the paramecium population were increasing at a constant rate. Help students see that the data table is a tool, but the graphing tool can add to the understanding, and therefore, analysis of the experiment. Point out where the units located on a data table—students often want to put the units on each line of the data table. Using the online graphing tool, Create-a-graph will force them to enter the units used in the x and y axis labels.  The student will construct a graph on which students will plot the population of paramecium by time data points using Create-a-graph.  <http://nces.ed.gov/nceskids/createagraph/default.aspx>  Before creating the graph, the teacher may ask students what kind of a graph would show the data best? Use the Create-a-graph tutorial to help students see why the line graph is a good representation of this data for our use. Discuss with students what the title and x and y axis labels should be. After students have made a line graph of the data, ask students to look at the table showing the paramecium population and time data, and ask them to identify patterns in the population on the table. Ask Students, if food is being given at regular intervals (meaning there is no change in the amount of food) then why does the population level off and stay at approx. 65 paramecium per ml? Which vocabulary word best describes what is happening with the data (carrying capacity) |
| **EXPLANATION**   * Student explanations should precede introduction of terms or explanations by the teacher. What questions or techniques will the teacher use to help students connect their exploration to the concept under examination? * List higher order thinking questions which teachers will use to solicit *student* explanations and help them to justify their explanations.   **Population**  **Carrying capacity**  **Limiting factor**  **competition**  **predation**  **parasitism**  **mutualism**  **commensalism**  **symbiosis**  **Paramecium** |
| **ELABORATION**   * Describe how students will develop a more sophisticated understanding of the concept. * What vocabulary will be introduced and how will it connect to students’ observations? * How is this knowledge applied in our daily lives?   Ask students in what step of the scientific method would the data be gathered for the data table. Ask which step of the Scientific Method would the graphing be produced? What step would come after the Data Analysis step of the Scientific Method?  Ask students why ecological interactions are important to a population? Answer: Interactions can affect distribution and abundance.  Ask students to make a hypothesis, or educated guess, about what will happen if no more food is added (the carrying capacity will drop and eventually all of the organisms will die.) |
| **EVALUATION**   * How will students demonstrate that they have achieved the lesson objective? * This should be embedded throughout the lesson as well as at the end of the lesson   Students will create a line graph with a correct title and that has correct labels for the x and Y axis. The graph must contain all the data points that exist in the data table.  **Students will choose three of the following statements to finish regarding the vocabulary words :**   * What word means that a population has reached the largest size that its environment can support? * What word means the opposite of Predator? * What is the relationship between the words: community and population? * What word(s) go with population? * What words describe types of symbiosis? |